ACCOUNTING FOR THE KNOWLEDGE ECONOMY

Comments By
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June 6, 2006

THE GOOD NEWS …

- We live in an era of rapid, almost dizzying, innovation in products and processes.
- These innovations have improved consumer welfare through
  - the introduction of new goods and services
  - improving quality and lowering the costs of existing products
  - increasing the amount of information about available products.
- These innovations have revolutionized the organization of production, not just the ‘technology’ of production as narrowly conceived

THE NOT SO GOOD NEWS …

- Measurement practice has lagged innovation in the real economy.
- Accounting practice has traditionally concentrated on market data and avoided making imputations where possible, and thus has avoided capitalizing intangibles like R&D. This is beginning to change in national accounting, but not financial accounting.
- Slow progress is adjusting price deflators for product innovation.

Notable Comments about Data:

- “You see the computer revolution everywhere except in the productivity data.” Solow 1987
- Official price and output data “miss the most important revolutions in history.” Nordhaus 1997
- Greenspan’s 1990 remarks on the bias in the CPI and the unreliability of service sector productivity data.
- “If making monetary policy is like driving a car, then the car is one that has an unreliable speedometer, a foggy windshield … .” Inadequate data is the foggy windshield. Bernanke 2004

MORE NOT SO GOOD NEWS … The econometric model of the firm

- In most conventional econometric treatments, the firm is a simple transformation of input into output via a production function, in order to maximize profit. This approach emphasizes productivity and sources of output growth.
- A firm is actually an organization that persists over time and tries to maximize wealth, and therefore invests in productive tangible capacity and ALSO makes firm-specific intangible investments in itself in order to innovate. This approach emphasizes the sources of long-term value growth.

Grab your iPod, flip it over, and read the script at the bottom. It says: "Designed by Apple in California. Assembled in China." Where the gizmo is made is immaterial to its popularity. It is great design, technical innovation, and savvy marketing that have helped Apple Computer sell more than 40 million iPods. Yet [current accounting practice] reduces Apple -- one of the world's greatest innovators -- to a reseller of imported goods."

Nature of Intangible Inputs

- Highly firm specific -- possible spillovers
- Not a continuous input to producing more output in production function
- Source of new products and processes
- Organizational overhead capital (micro counterpart of macro social capital)
- Coinvestments (advertising and R&D, training and IT investment)

Economic Theory Strongly Favors Treating R&D as an Investment

- Standard Intertemporal Optimization indicates that investment is deferred consumption
- Symmetry Case for Intangibles: if a tangible expenditure that is intended to increase future output and consumption is investment, then so is an intangible expenditure that does the same.

What Is to Be Done?

- Move toward knowledge-base accounting by
  - capitalizing knowledge-related intangible investments
  - increased emphasis on incorporating quality change and new products into price statistics
  - improving measures of tangible capital, particularly in the areas of embodied capital-embodied technical change, depreciation, and obsolescence
  - increased emphasis human capital and ‘human-embodied’ technical change, and the links to the household sector
- Link innovation surveys and metrics to accounting structures

WHAT'S AT STAKE

A CONCRETE EXAMPLE
OF AN R&D
INTENSIVE COMPANY

Rough Estimate of Modified
Corporation Income Statement
MERCK 2004
(Billions of $)

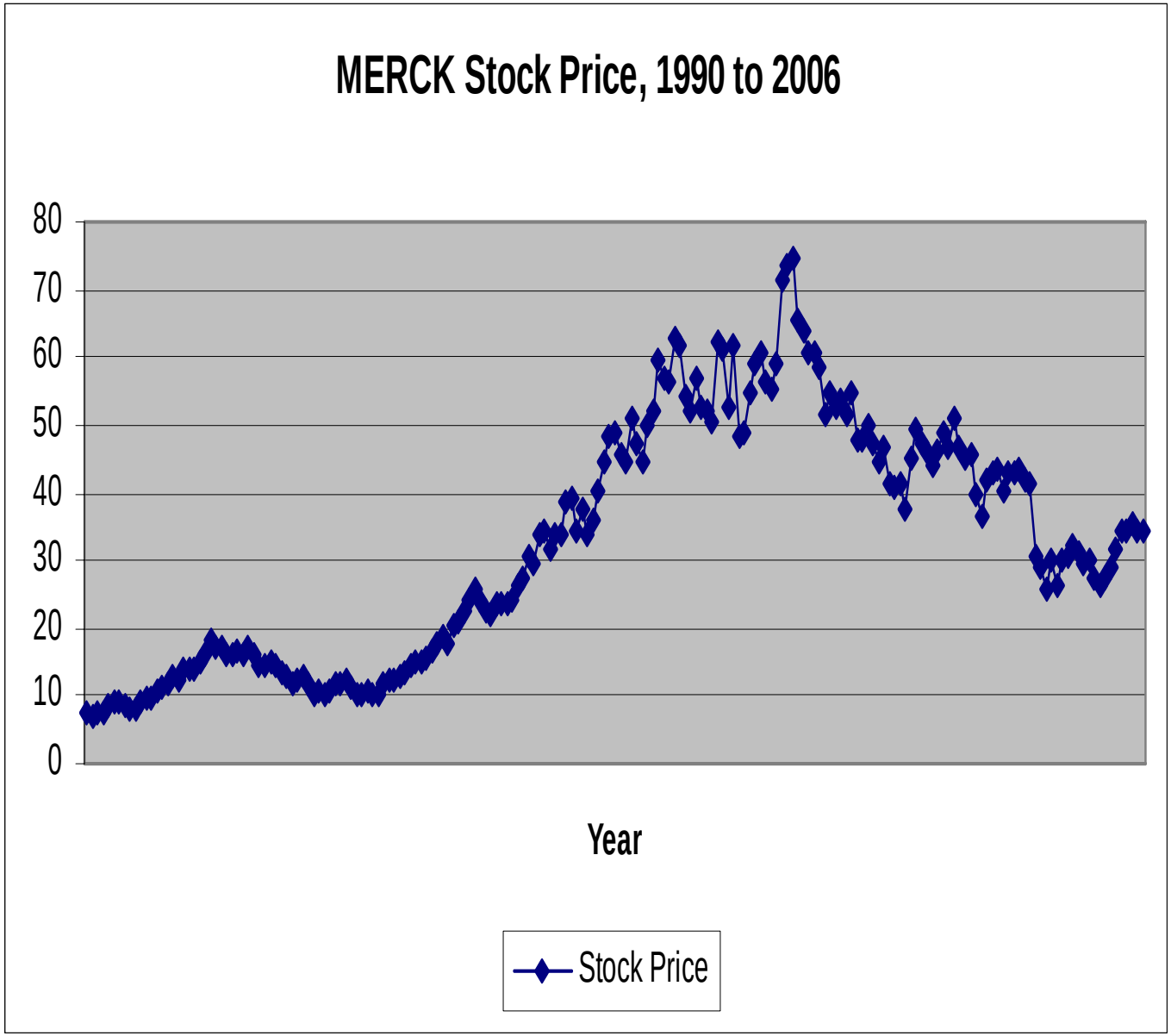
Items	Conventional Account
Revenues	$22.9
Cost of Sales	- $3.7
SG&A	- $7.3
R&D expend.	- $4.0
Gross Income	= $7.9
Net Int. & Other	+ $1.4
Depreciation	- $1.3
Before-Tax Profit	= $8.0
Taxes	- $2.2
After-Tax Profit	= $5.8
Dividend	$3.3
Retained Earnings	$2.5
Total Assets	$42.6
Net Fixed Assets	$14.8
New Intangibles	$0
CAPEX	$1.7

Rough Estimate of Modified
Corporation Income Statement
MERCK 2004
(Billions of $)

Items	Conventional Account	Add R&D
Revenues	$22.9	$26.9
Cost of Sales	- $3.7	- $3.7
SG&A	- $7.3	- $7.3
R&D expend.	- $4.0	- $4.0
Gross Income	= $7.9	= $11.9
Net Int. & Other	+ $1.4	+ $1.4
Depreciation	- $1.3	- $3.3
Before-Tax Profit	= $8.0	= $9.9
Taxes	- $2.2	- $2.2
After-Tax Profit	= $5.8	= $7.8
Dividend	$3.3	$3.3
Retained Earnings	$2.5	$4.5
Total Assets	$42.6	$58.1
Net Fixed Assets	$14.8	$14.8
New Intangibles	$0	$15.5
CAPEX	$1.7	$5.7

Rough Estimate of Modified
Corporation Income Statement
MERCK 2004
(Billions of $)

Items	Conventional Account	Add R&D	Add R&D+ 1/3 SG&A
Revenues	$22.9	$26.9	$29.4
Cost of Sales	- $3.7	- $3.7	- $3.7
SG&A	- $7.3	- $7.3	- $7.3
R&D expend.	- $4.0	- $4.0	- $4.0
Gross Income	= $7.9	= $11.9	= $14.3
Net Int. & Other	+ $1.4	+ $1.4	+ $1.4
Depreciation	- $1.3	- $3.3	- $5.2
Before-Tax Profit	= $8.0	= $9.9	= $10.5
Taxes	- $2.2	- $2.2	- $2.2
After-Tax Profit	= $5.8	= $7.8	= $8.3
Dividend	$3.3	$3.3	$3.3
Retained Earnings	$2.5	$4.5	$5.0
Total Assets	$42.6	$58.1	$64.5
Net Fixed Assets	$14.8	$14.8	$14.8
New Intangibles	$0	$15.5	$21.9
CAPEX Total	$1.7	$5.7	$8.2


MERCK Stock Price, 1990 to 2006
80
70
60
50
40
30
20
10
0
Year
Stock Price

REMARKS

- NEED R&D *OUTPUT* PRICE DEFLATOR TO CONSTRUCT CONSTANT PRICE ACCOUNT
- NEED ESTIMATE OF R&D GESTATION LAG TO ACCOUNT FOR TIME VALUE OF MONEY
- NEED DEPRECIATION RATE FOR BOTH INCOME STATEMENT AND BALANCE SHEET
- PROBLEM OF EXTERNALITIES

OUTPUT DEFLATOR IS MOST PRESSING PROBLEM

- Research is an input into the production of further research; thus, price deflators based on input costs tend to ignore the resulting productivity gains.
- Product innovation leads to quality improvement and new goods; the R&D price deflators may need to account for these improvements.

Intangible Capital and Economic Growth

Carol Corrado, Charles Hulten, and Daniel Sichel*

October 2005

$1 trillion of Intangible Investment U.S. Nonfarm Business, 1998-2000

- COMPUTERIZED INFORMATION ($154,$154)
  - COMPUTER SOFT WARE ($151)
  - COMPUTERIZED DATABASES ($3)

- SCIENTIFIC PROPERTY ($424,$424)
  - SCIENTIFIC R&D ($184)
  - MINERAL EXPLORATION ($18)
  - COPYRIGHT AND LICENCE COSTS ($75)
  - OTHER PRODUCT DEVELOPMENT (FINANCE, ARCHIT.) ($149)

- ECONOMIC COMPETENCIES ($642,$505)
  - BRAND EQUITY (ADVERTISING) ($236)
  - FIRM-SPECIFIC HUMAN CAPITAL (TRAINING) ($116)
  - ORGANIZATIONAL STRUCTURE MANANGEMENT CONSULTING, PLANNING ETC.) ($291)

Many Tough Measurement Issues

- What are the appropriate ‘boundaries’ on this exercise?
- How to value firm-specific capital that has no arms-length market valuation?
- How much approximation and imputation is permissible?
- How much difference does it make, anyway?

BUT …

KEYNES: “IT’S BETTER TO BE IMPRECISELY RIGHT THAN PRECISELY WRONG”

Particularly if being imprecisely right makes a difference.

Table 4
Value of Output and Inputs, Nonfarm business sector, 2000-2003
(annual average, billions of dollars)

	Conventional, without Intangibles Equation (1d)	This paper, with Intangibles Equation (2d)
Conventional output	7670	7670
+ Intangible Investment	0	1206
= Nominal output	7670	8876
- Indirect business taxes	736	736
- Statistical discrepancy	-52	-52
= Total income	6986	8192
Total income	6986	8192
= Labor compensation	4915	4915
+ Income Accruing to Tangible Capital	2071	2046
+ Income Accruing to Intangible Capital	0	1231

Source: Corrado, Hulten, Sichel (2006)

A Longer List on Intangibles Leads to a Big Effect in 2000

- ~ $1 trillion in “extra” investment, an amount equal to tangible investment, and $1 trillion in “extra” GDP, a 10% increase
- a growing RATE of investment
- a falling share of income for labor
- ~ $3.6 trillion extra capital stock (PDE was around $4.3 trillion)
- change the rate and composition of growth toward capital and ‘knowledge’

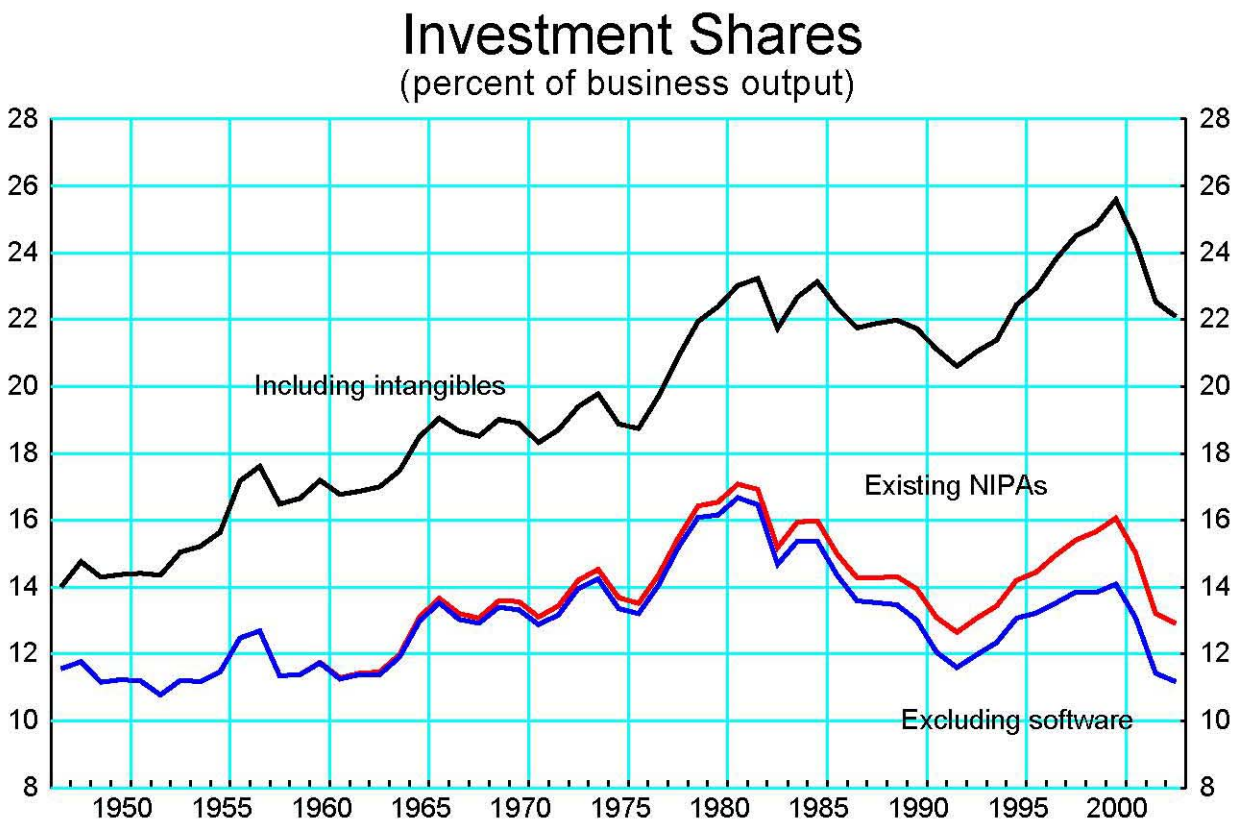
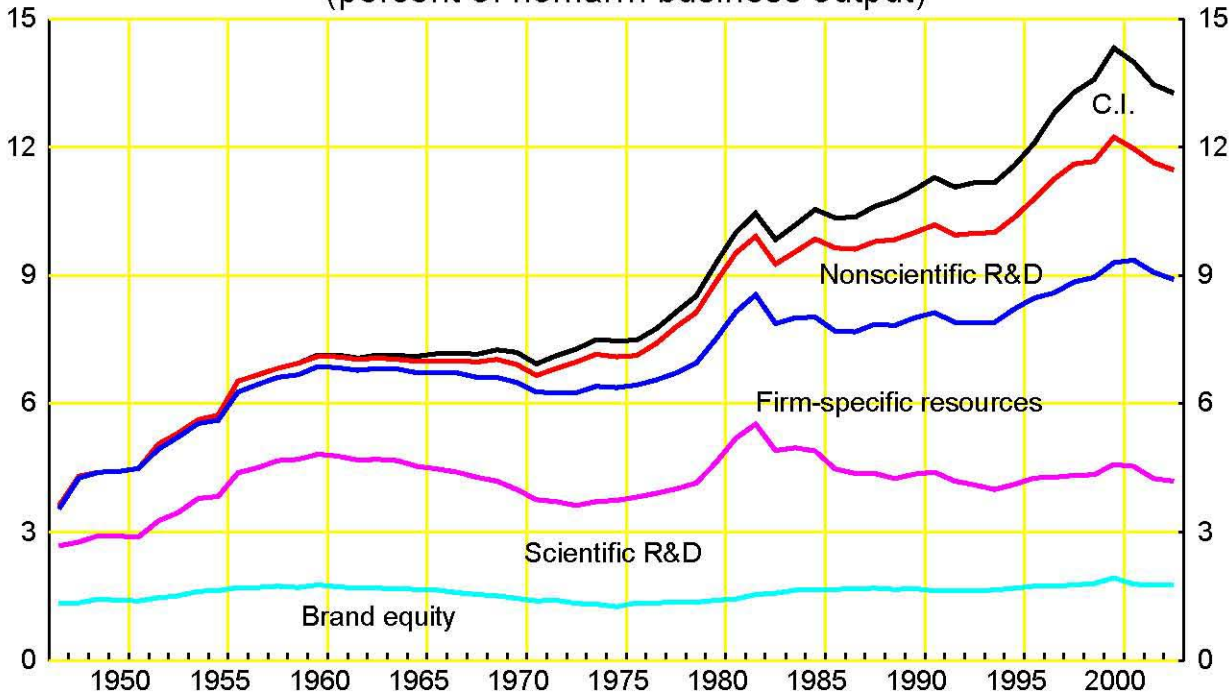

Investment Shares
(percent of business output)
28
26
24
22
20
18
16
14
12
10
8
Including intangibles
Existing NIPAs
Excluding software
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000

Figure 2

Intangible Investments

(percent of nonfarm business output)

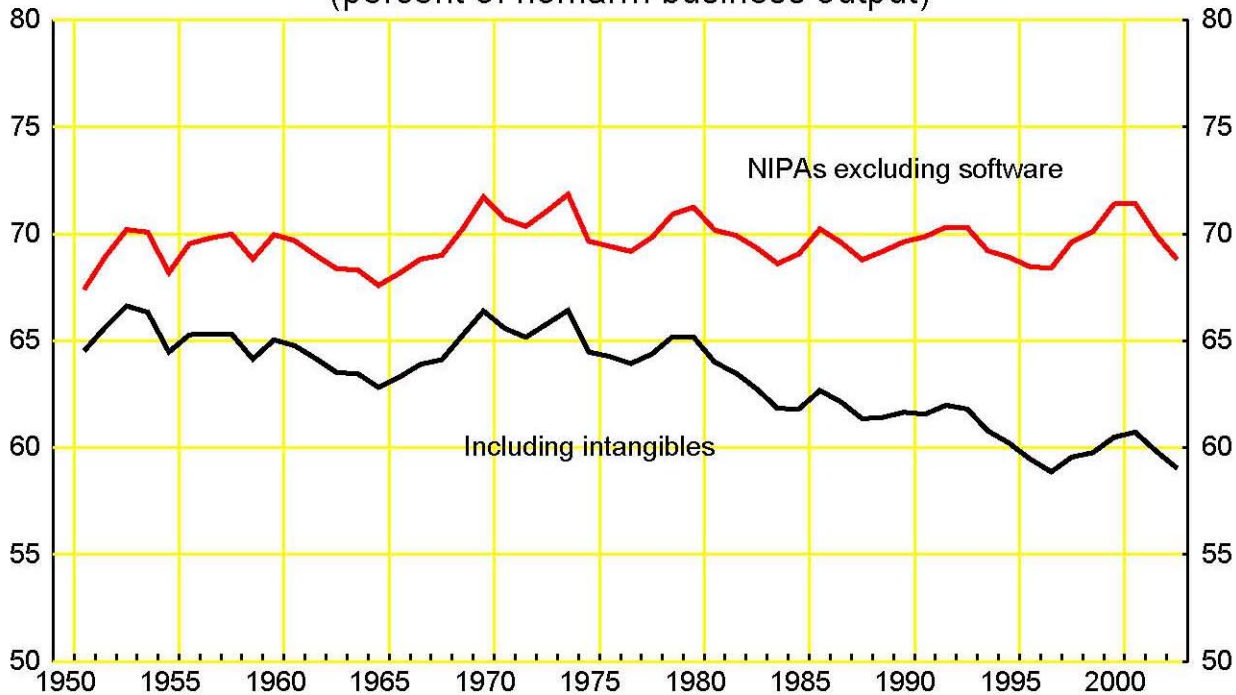


Note: C.I. = Computerized information

Figure 3

Labor Shares

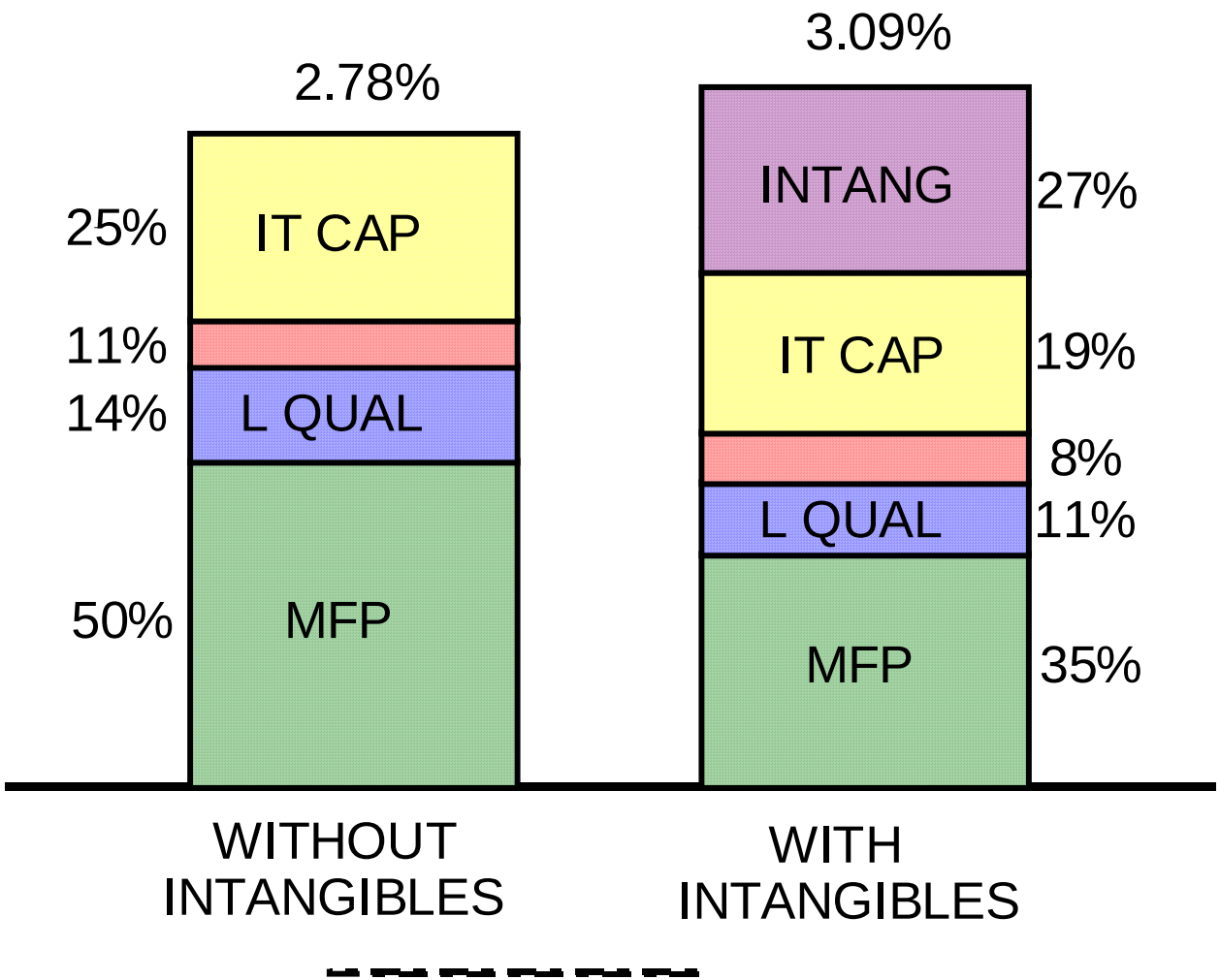
(percent of nonfarm business output)



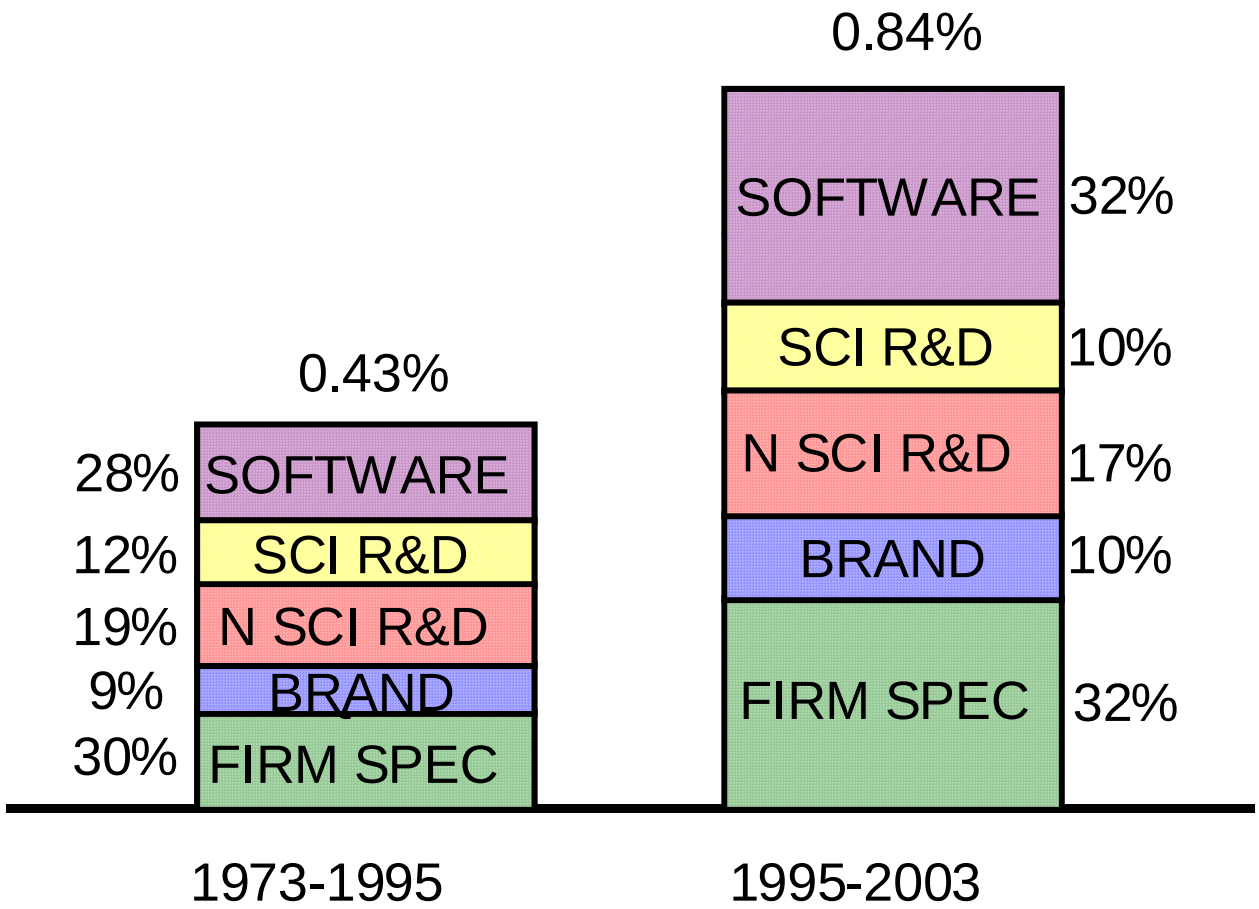
Note: BLS basis (output excludes government enterprises, labor income includes nonemployees).

SOURCES OF GROWTH IN OUTPUT PER HOUR

NFB 1995-2003



CONTRIBUTION OF DIFFERENT INTANGIBLES TO ANNUAL CHANGE IN LABOR PRODUCTIVITY



CONCLUSIONS

- The growth in intangible capital is strongly related to innovation and economic growth, and is necessary for an accurate picture of the growth process
- Intangible capital is considerably broader than software and scientific R&D
- The non-scientific components of intangible capital are some of the mort important sources of growth
- Capitalizing a broad range of intangibles poses hard measurement problems, but not impossible problems